SECTION I

DESCRIPTION

The function of this section is to describe the helicopter and its systems and controls which contribute to the physical act of flying the helicopter, including all emergency equipment that is not part of auxiliary equipment.

TABLE OF CONTENTS

HELICOPTER

Model HH52A helicopters are manufactured by Sikorsky Aircraft, a Division of United Technologies Corporation, Stratford, Connecticut. The amphibious type helicopter is designed for search, rescue, and observation operations. Configuration is single engine, three-bladed main lifting rotor, two-bladed antitorque tail rotor, and sponson mounted retractable landing gear. The sponsons, one at each main landing gear, together with the watertight lower fuselage will provide stability in the water. Dimensions of the helicopter are shown at the end of this paragraph and on figure 1-1. Refer to the exterior and interior general arrangement illustration in this section and the minimum turning radius and ground clearances diagram in Section I for further familiarization. The helicopter's maximum gross weight is 8300 pounds with 8100 pounds used for normal operations. For complete weight information see HH52A Weight and Balance Data Book (T. O. 1-1B-40). The boat hull type fuselage is of metal semimonocoque construction and is comprised of five sections: the cockpit section, the cabin section, the transition section, the tail cone section, and the tail pylon section. The entire fuselage, below the cabin floor, is of watertight construction. The cockpit, (figure 1-2), is equipped with dual flight controls and is entered from the cabin. Directly behind the cockpit is the cabin section. The cabin section is approximately 14 feet long, 5 feet 4 inches wide, and 6 feet high. Entrance to the cabin section is through a 4 foot wide, 5 foot high, sliding door. The cabin section may be equipped with 10 troop seats for passenger accommodations or 6 litters and 3 troop seats. The cabin is equipped with tiedown rings for transportation of cargo. A 600-pound capacity hydraulic rescue hoist with approximately 100 feet of usable cable is suspended on a fixed truss over the cargo door. Two single-cell fuel tanks are installed below the cabin floor in the watertight lower fuselage section. Aft of the cabin is the transition section which contains the cabin heater and electrical equipment. The tail cone section extends aft from the transition section. The tail pylon extends from the end of the tail cone and provides mounting facilities for the tail rotor gear box and associated pitch change control linkages. The engine compartment is above the cabin. The engine is installed with the drive shaft pointed rearward and connected to the main gear box. The transmission compartment housing the main gear box is on the top of the fuselage directly behind the engine compart-

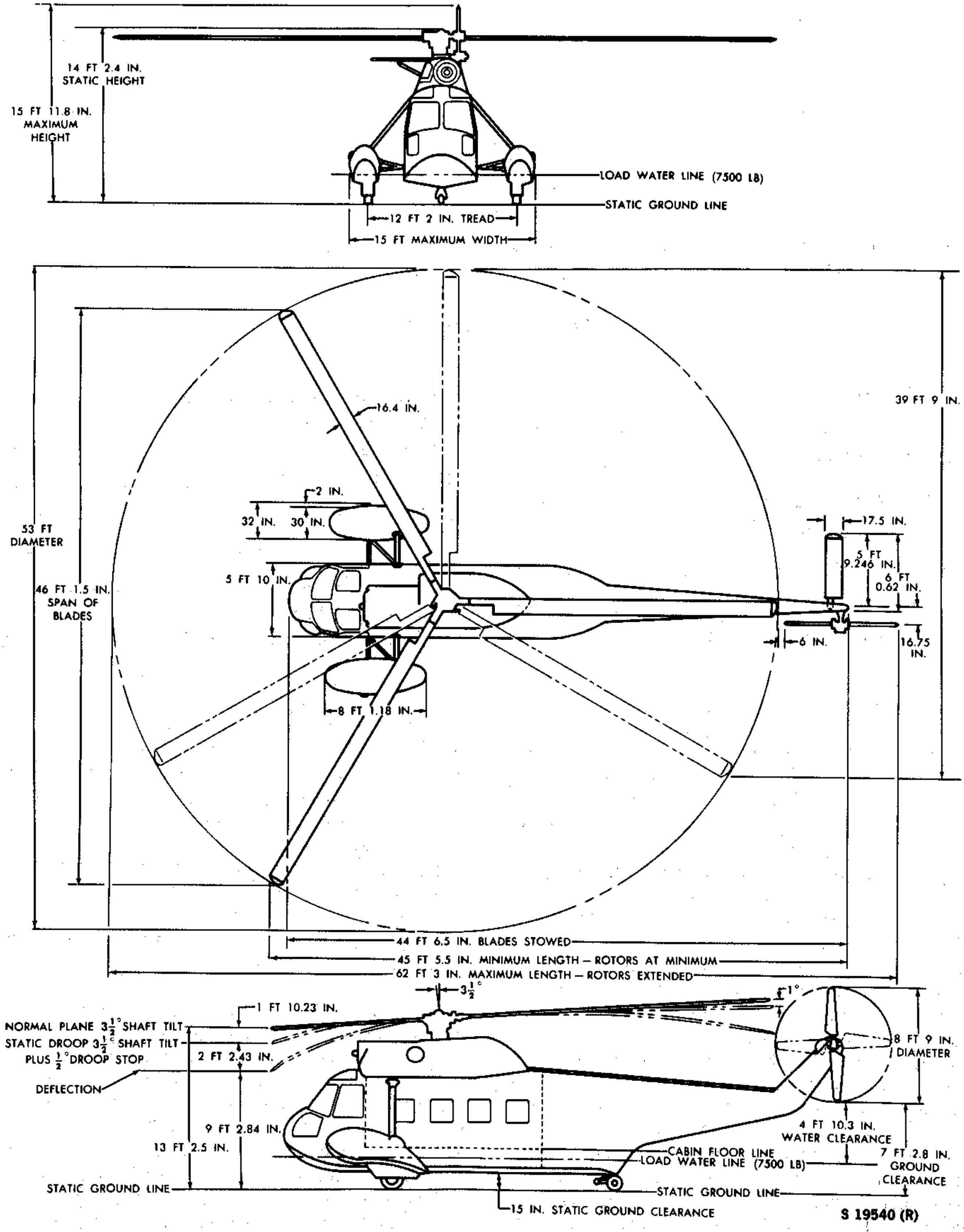
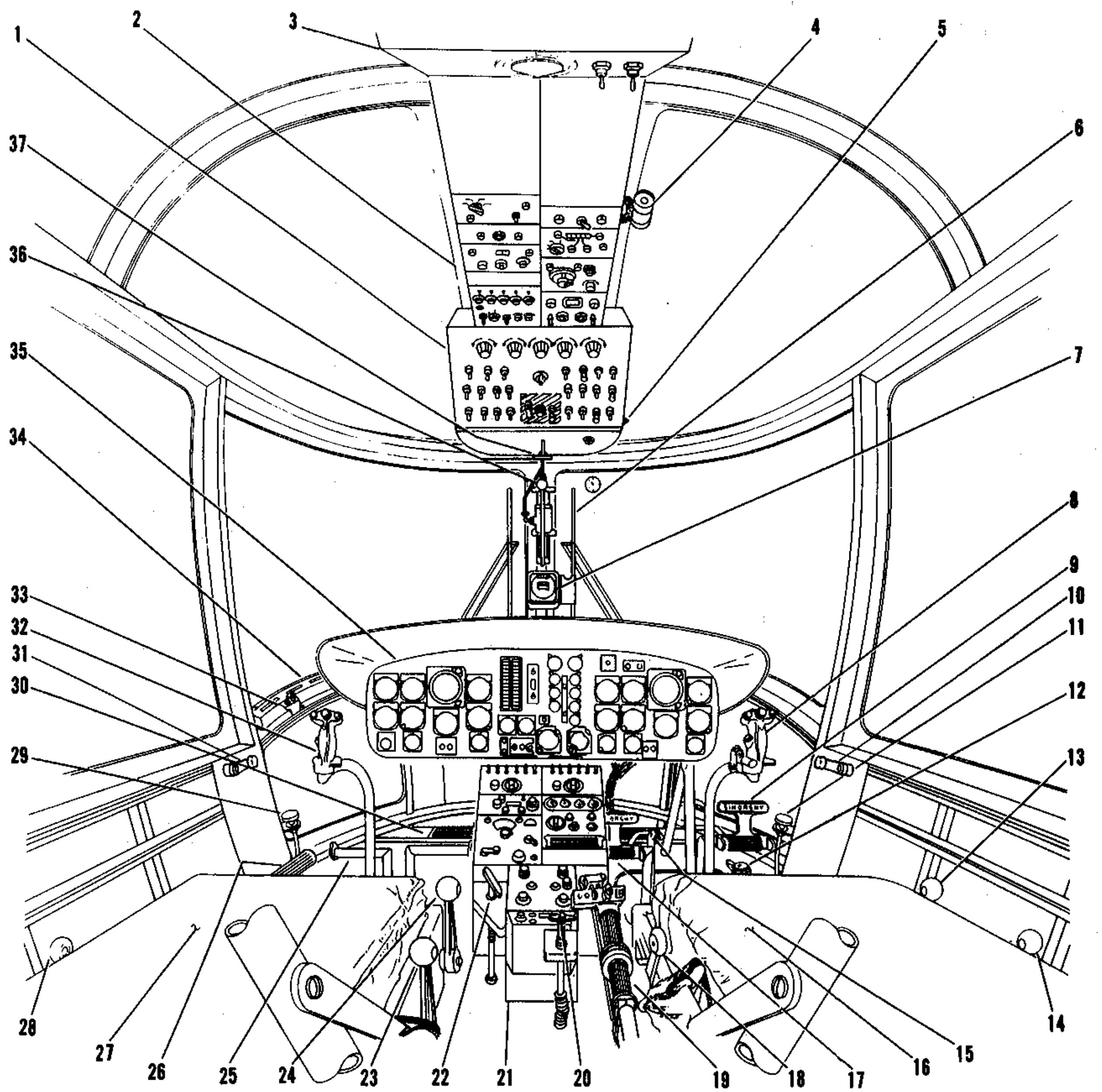


Figure 1-1. Three View Dimensions



1. OVERHEAD SWITCH PANEL
2. OVERHEAD RADIO PANEL
3. OVERHEAD DOMELIGHT PANEL
4. PILOT'S COMPARTMENT SPOTLIGHT
5. P3 VALVE
6. WINDSHIELD WIPER
7. MAGNETIC STANDBY COMPASS
8. PILOT'S CYCLIC STICK
9. PILOT'S BRAKE PEDAL
10. PILOT'S WINDOW EMERGENCY RELEASE HANDLE
11. PILOT'S TAIL ROTOR PEDAL ADJUSTMENT KNOB
12. WINDSHIELD WASHER FOOT PEDAL
13. SEAT FORWARD OR AFT ADJUSTMENT LEVER
14. SEAT HEIGHT ADJUSTMENT LEVER
15. HEATER REGISTER
16. PILOT'S SEAT
17. PILOT'S TAIL ROTOR PEDAL
18. PILOT'S SHOULDER HARNESS INERTIA REEL LOCK LEVER
19. PILOT'S COLLECTIVE PITCH LEVER
20. TAILWHEEL LOCK HANDLE
21. CONSOLE
22. PARKING BRAKE HANDLE
23. COPILOT'S SEAT HEIGHT ADJUSTMENT LEVER
24. COPILOT'S SEAT FORWARD OR AFT ADJUSTMENT LEVER
25. COPILOT'S TAIL ROTOR PEDAL
26. COPILOT'S COLLECTIVE PITCH LEVER
27. COPILOT'S SEAT
28. COPILOT'S SHOULDER HARNESS INERTIA REEL LOCK LEVER
29. COPILOT'S TAIL ROTOR PEDAL ADJUSTMENT KNOB
30. HEATER REGISTER
31. COPILOT'S WINDOW EMERGENCY RELEASE HANDLE
32. COPILOT'S CYCLIC STICK
33. COPILOT'S REMOTE ICS SWITCH AND LANDING LIGHT CONTROL SWITCH
34. WINDSHIELD DEFROSTER VENTS
35. INSTRUMENT PANEL
36. ROTOR BRAKE LEVER
37. FIRE WALL VALVE SHUTOFF HANDLE

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Figure 1-2. Cockpit

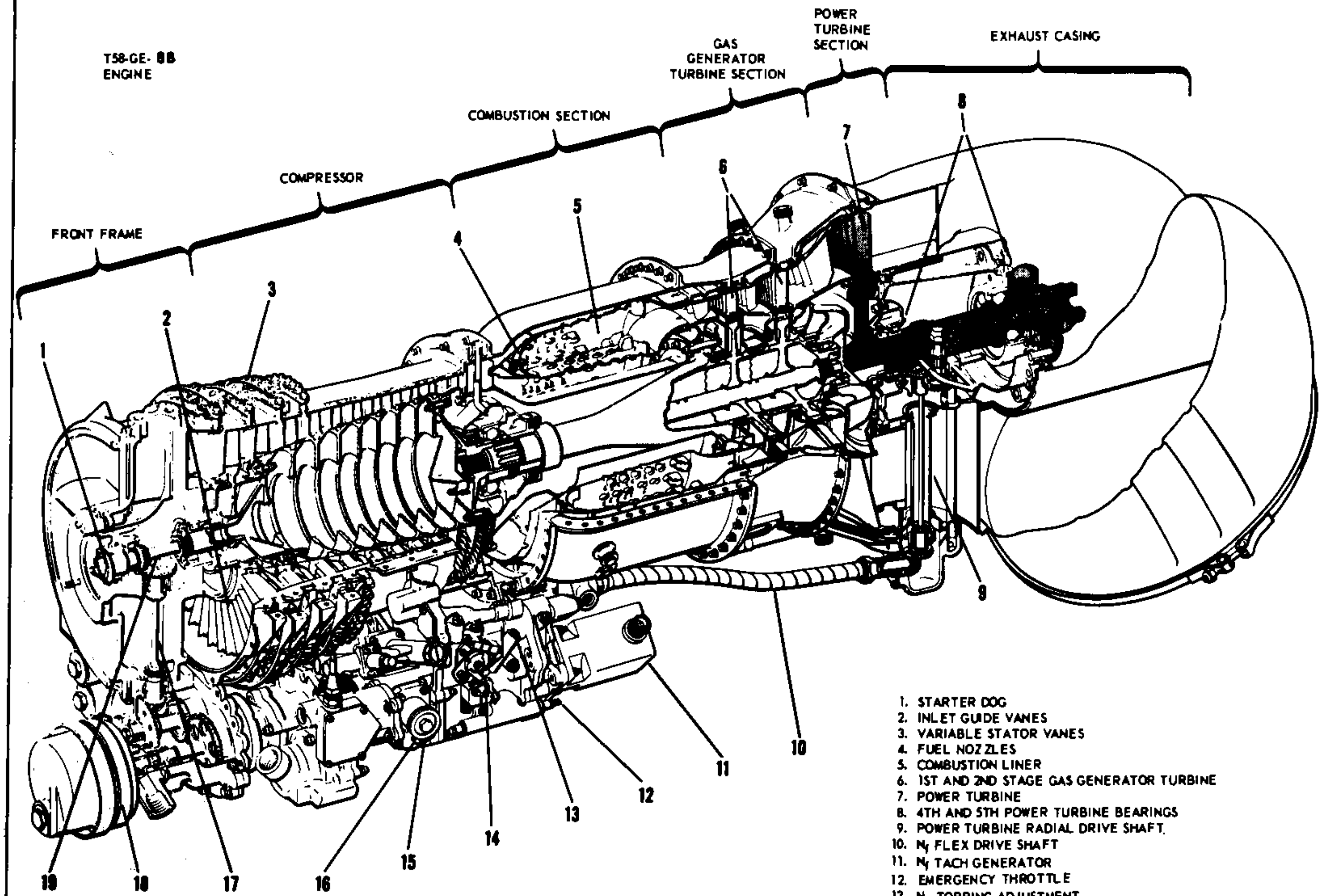
ment. The main rotor drive shaft extends vertically from the top of the main gear box. The main rotor hub assembly, to which the main rotor blades are attached, is splined to the top of the main rotor drive shaft. The tail rotor drive shaft extends rearward from the main gear box tail rotor takeoff shaft, to the intermediate gear box input shaft. The intermediate gear box is installed in the lower portion of the pylon and its output shaft extends upward to the tail rotor gear box input shaft. The tail rotor gear box output shaft is splined to the tail rotor hub. The two-bladed tail rotor is splined to the tail gear box shaft. Two of the main rotor blades may be folded aft parallel to the fuselage to aid storage.

DIMENSIONS

Length	
Maximum main and tail rotor blades extended	62 feet 3 inches
Minimum main and tail rotors at minimum	45 feet 5.5 inches
Minimum main and tail rotor blades removed	44 feet 6.5 inches
Height	
Maximum tail rotor blade vertical	15 feet 11.8 inches
Tail rotor diameter	8 feet 9 inches
Minimum to top of hoisting eye	14 feet 2.4 inches
Width	
Minimum main rotor blades removed	15 feet 7.5 inches
Main rotor diameter	53 feet 00 inches
Minimum Main Rotor Ground Clearance (Tip clearance — forward section) Static	9 feet 2.84 inches
Tail Rotor Ground Clearance	7 feet 2.8 inches
Main Landing Gear Trend	12 feet 2 inches
Draft	
Maximum draft at gross weight of 7500 pounds (From waterline to bottom of retracted wheels)	13.5 inches

ENGINE

The helicopter is equipped with a General Electric T58-GE-8B turbo shaft engine (figure 1-3) which has a design performance rating under standard sea level static conditions of 1250 shaft horsepower. When installed in the HH-52A helicopter, however, this is reduced to 845 shaft horsepower due to helicopter dynamic component limitations. This reduction is accomplished by physically derating the fuel control by limiting maximum fuel flow to 575 pounds per hour with maximum variation of plus 25 and minus zero pounds per hour. The T58 engine is a compact turboshaft engine with high power-to-weight ratio and uses the free turbine principle. The engine is mounted above the cockpit left of the aircraft centerline forward of the main transmission. The engine consists of these major components: an axial-flow compressor, combustion chamber, a two-stage gas generator turbine, accessory section and a single-stage free power turbine. The free power turbine is mechanically independent of the gas generator and, within the power turbine governing range, power turbine speed is independent of output power. High torque is available at low output speeds, providing rapid acceleration characteristics. The gas generator consists of the compressor, annular combustion chamber, two-stage gas generator turbine and the accessory section. The free turbine principle provides a constant free turbine speed output which results in a constant rotor RPM. Variations in power requirements to maintain constant free turbine speed are accomplished by automatic increases or decreases in gas generator speed. A hydromechanical fuel metering (control) unit provides maximum engine performance without exceeding safe engine operating limits. In the normal operating range engine speed is selected by positioning the speed selector. The integrated fuel control system delivers atomized fuel in controlled amounts to the combustion chamber. Flow of fuel and air through the combustion chamber is continuous, and once the mixture is ignited, combustion is self-sustained. Changes in air pressure, air temperature, and rotor operation all affect engine performance. The engine fuel control sys-



1. STARTER DOG
2. INLET GUIDE VANES
3. VARIABLE STATOR VANES
4. FUEL NOZZLES
5. COMBUSTION LINER
6. 1ST AND 2ND STAGE GAS GENERATOR TURBINE
7. POWER TURBINE
8. 4TH AND 5TH POWER TURBINE BEARINGS
9. POWER TURBINE RADIAL DRIVE SHAFT.
10. N_f FLEX DRIVE SHAFT
11. N_f TACH GENERATOR
12. EMERGENCY THROTTLE
13. N_g TOPPING ADJUSTMENT
14. NORMAL SPEED SELECTOR
15. FUEL CONTROL DENSITY ADJUSTMENT
16. FUEL CONTROL FUEL INLET FILTER
17. FRONT FRAME RADIAL DRIVE SHAFT
18. CENTRIFUGAL FUEL FILTER
19. AXIAL DRIVE SHAFT

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Figure 1-3. Engine Cut-away View

tem automatically maintains selected power turbine speed (Nf) in the Nf governing range by changing fuel flow to increase or decrease gas generator speed as required, thus regulating output power to match the load under changing conditions. In the event of automatic fuel control malfunction, the emergency throttle is used to manually control fuel flow through the main metering valve. An electric solenoid-operated bleed valve is installed in the P3 signal tubing to the automatic fuel control to provide an instant power reduction if the main rotor enters an overspeed condition. A manual bleed valve (figure 1-4) is in the P3 signal tubing to the automatic fuel control, to permit the pilot to reduce fuel flow during starting. Free power turbine overspeed protection is achieved by automatic fuel cut-off when the power turbine enters an overspeed condition. The accessory drive section, mounted on the front frame and extending beneath the compressor, transmits the necessary power to drive the lube scavenge pump, fuel pump, and dynamic fuel filter. The Ng tachometer generator is driven by the lube pump and the Ng governor, which is in the automatic fuel control, is driven by the fuel pump. Engine exhaust gases are discharged through the exhaust casing extending through an opening on the left side of the fairing that surrounds the engine and main gear box. Small openings in the fairing on both sides of the engine also aid in dissipating engine heat. The openings on the right side have normally open shutters which are a part of the engine fire extinguisher system.

COMPRESSOR

The ten-stage compressor consists of the compressor rotor and stator. The primary purpose of the compressor is to compress air for combustion. Ambient air enters through the front frame and is directed to the compressor inlet, where it passes through ten stages of compression, and is directed to the combustion chambers. The inlet guide vanes (2, figure 1-3) and the first three stages of the stator vanes (3, figure 1-3) are variable and change their angular position, as a function of compressor inlet temperature and gas generator speed, to prevent stall of the compressor.

COMBUSTION CHAMBER

In the combustion chamber fuel is added to the compressed air. This mixture is ignited, causing a rapid expansion of gases toward the gas generator turbine section. As the air enters the combustion section, a portion goes into the combustion chamber where it is mixed with the fuel and ignited, while the remaining air forms a blanket between the outer combustion casing and the combustion liner (5, figure 1-3), for cooling purposes. Once combustion is started by the two igniter plugs, it is selfsustaining. After the air has been expanded and increased in velocity by combustion, it is passed through the two-stage gas generator turbine.

GAS GENERATOR TURBINE

The two-stage gas generator turbine (6, figure 1-3) is the rotating component which is coupled directly to the compressor. It extracts the required power from the exhaust gases to drive the compressor. The turbine nozzles that comprise the stator blades direct the exhaust gases to the turbine wheels.

GAS GENERATOR SPEED (Ng)

Gas generator speed (Ng) is primarily dependent upon fuel flow and is monitored by the engine fuel control unit. The principal purpose of monitoring Ng is to control acceleration and deceleration characteristics, prevent overspeed, and establish a minimum idle setting. Gas generator speed controls airflow through the engine and consequently the power available to the power turbine.

POWER TURBINE

The power turbine (7, figure 1-3) is bolted to the rear flange of the second stage turbine casing. The engine utilizes the free turbine principle, which is characterized by a power turbine which is mechanically independent of the gas generator. The power turbine derives its power from the gases which are directed to it by the gas generator turbine nozzles.

Power Turbine Speed (Nf)

Power turbine speed is transmitted to the Nf governor in the fuel control by a flexible drive shaft (figure 1-3). The Nf governor regulates fuel flow to maintain an essentially constant power turbine speed for a given speed selector setting within the Nf governing range, 85% to 106% Nf.

POWER TURBINE OVERSPEED SYSTEM

The Nf governor will actuate the overspeed shutoff valve in the fuel control at 122% Nf to prevent destructive overspeed of the power turbine. Actuation of the overspeed shutoff valve causes an immediate flameout. When Nf falls below 122% Nf the overspeed shutoff valve will reopen, admitting fuel to the engine, which may result in uncontrolled ignition followed by overtemperature.

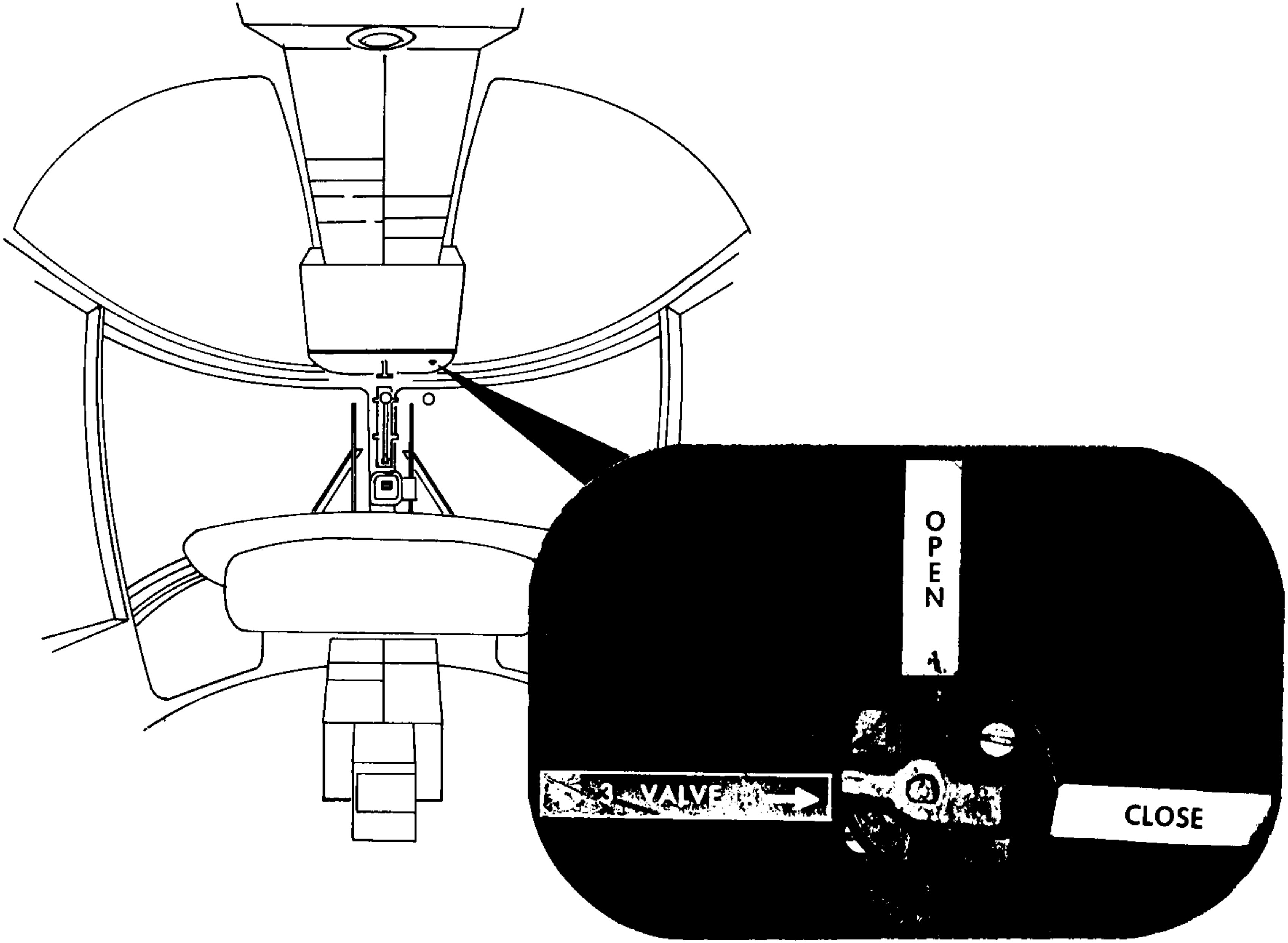

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Figure 1-4. Manual P_3 Bleed

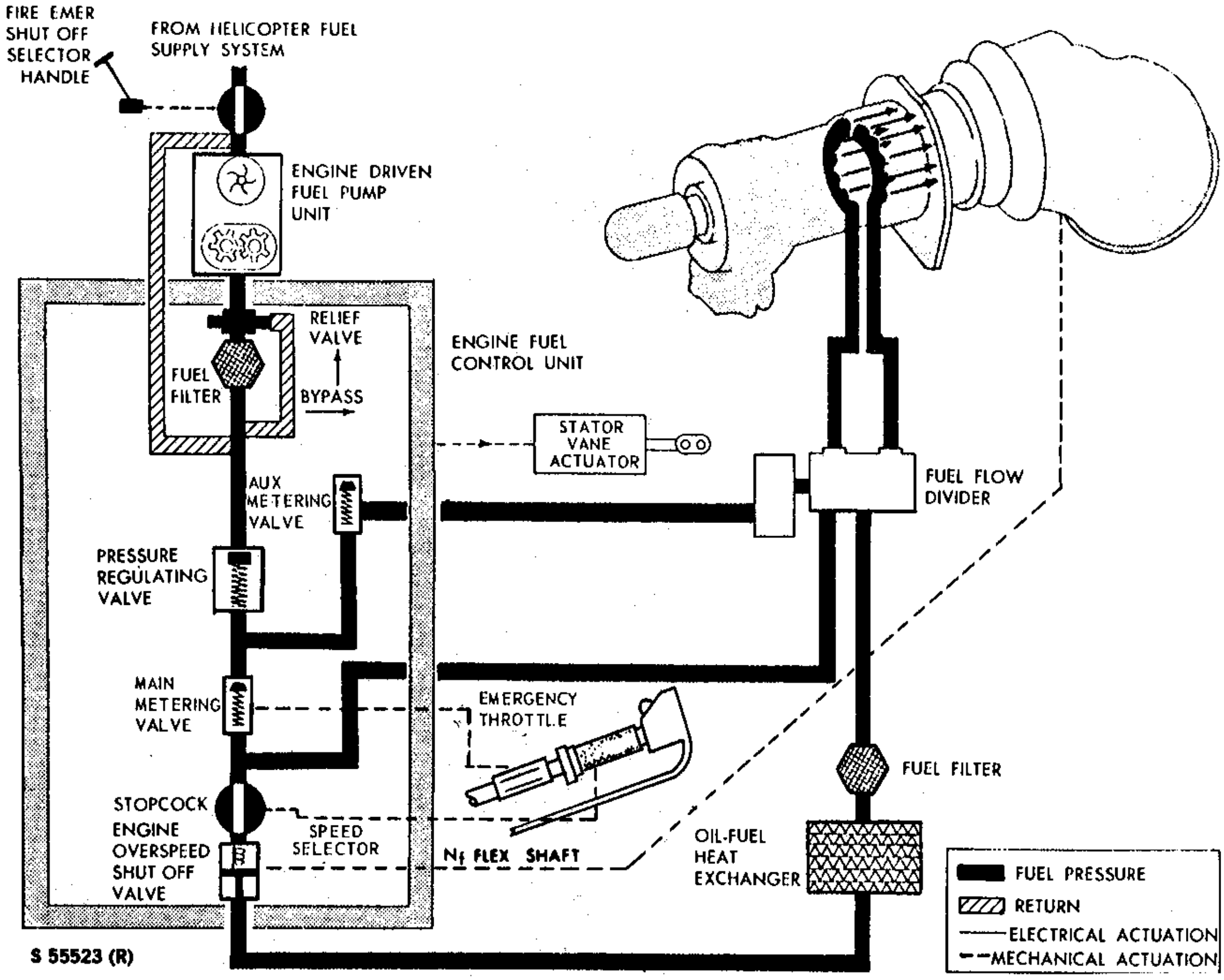


Figure 1-5. Engine Fuel System

WARNING

This system is inoperative following power turbine flexible drive shaft failure.

ENGINE FUEL SYSTEM

The engine fuel system (figure 1-5), consists of a dynamic fuel filter, an engine driven pump, a fuel control unit, an oil cooler, a static fuel filter, a flow divider, and a fuel manifold with nozzles and associated piping. The fuel control unit is supplied fuel from the engine-driven fuel pump. Metered fuel from the engine fuel control unit is piped through an oil-fuel heat exchanger and then enters the flow divider which is connected directly to the fuel manifold on the engine.

Dynamic Fuel Filter

The dynamic fuel filter is mounted on the forward face of and receives power from the engine accessory drive casing. It receives fuel from the airframe fuel system and removes impurities by centrifugal action.

Engine-Driven Fuel Pump

A dual-element engine-driven fuel pump, mounted on the left rear face of the accessory drive casing, consisting of a centrifugal and a positive displacement gear type element, is built into a single housing. Power is furnished by the engine accessory drive case by means of a splined shaft. This shaft drives the fuel pump and simultaneously acts as a link to transmit gas generator speed information to the N_g governor in the fuel control unit.

Engine Fuel Control Unit

The fuel control unit is a hydro-mechanical device. It is mounted on the engine-driven fuel pump which supplies fuel under pressure to the unit. The fuel control consists of a single housing that contains elements necessary to sense five parameters of engine operation; compressor inlet temperature (T_2), gas generator speed (N_g), compressor discharge pressure (P_3), power turbine speed (Nf), and speed selector positions. Based on these five parameters the fuel control performs the following functions: governs gas generator idle and maximum speeds; maintains constant power turbine speed in the Nf governing range, when selected; schedules inlet guide vane and variable stator vanes for optimum compressor performance and prevents compressor stalls, turbine over-temperatures, and rich or lean flameouts. Failure of the power turbine flexible driven shaft causes the Nf governor to sense a false underspeed condition which induces the fuel control to meter maximum fuel flow. Significant power reduction in case of rotor overspeed is accomplished in the fuel control by bleeding part of the compressor discharge pressure signal. The false signal thus sensed by the fuel control results in an immediate reduction of fuel flow.

Engine Speed Selector

Twist grip type speed selectors used for normal engine operation are on the forward end of the pilot's and copilot's collective pitch levers (figure 1-20). Design of the pilot's speed selector provides two ranges of operation, a starting range extending from stopcock to idle and an operating range extending from idle to maximum power turbine speed. The starting range has two positions termed STOPCOCK and GROUND IDLE. STOPCOCK is at full clockwise rotation and GROUND IDLE is at full counterclockwise rotation against a mechanical stop. The operating range is selected by pushing the speed selector forward from the GROUND IDLE position until a mechanical stop is encountered. The operating range has three positions termed FLIGHT IDLE, AUTO DETENT, and MAXIMUM Nf. FLIGHT IDLE is at full clockwise rotation against a mechanical stop and except for being in the operating range on the speed selector, is identical to ground idle. AUTO DETENT is midway toward the full counterclockwise rotation. MAXIMUM Nf is at full counterclockwise rotation. The pilot's speed selector has full authority from STOPCOCK to MAXIMUM Nf but the copilot's speed selector has authority only in the range of operation selected by the pilot. A friction adjustment is located on the pilot's speed selector. Counterclockwise rotation increases friction while clockwise rotation decreases it. When starting the engine, the speed selector must be in the STOPCOCK position. A pulley limit switch which is closed when the speed selector is in the STOPCOCK position permits the starter to be energized when the starter switch is actuated. The speed selector is mechanically linked to the fuel control stopcock to assure positive cutoff of all fuel flow to the engine in the STOPCOCK position. The stopcock is open when the speed selector is rotated counterclockwise out of the STOPCOCK position. Subsequent to rotor engagement, the speed selector controls N_g until Nf reaches 85% or greater, then it functions as the power turbine speed selector.

Emergency Throttle

Twist-grip type emergency throttles are aft of the speed selectors on the pilot's and co-pilot's collective pitch levers. (figure 1-20). The emergency throttle is always positioned fully clockwise in the CLOSED position except when in use. Counterclockwise rotation of the emergency throttle increases fuel flow. A pulley limit switch which is closed when the emergency throttle is closed, permits the starter to be energized when the starter switch is actuated. The primary function of the emergency throttle is to manually override the automatic features of the fuel control. The initial position of the fuel metering valve is dependent upon the automatic features of the fuel control as established by the setting of the speed selector. The emergency throttle is mechanically connected to a cam within the fuel control. This cam, when actuated by advancing the emergency throttle, contacts the fuel metering valve. Once contact is established, further advance of the emergency throttle will manually control fuel flow, which in turn regulates engine power output. The emergency throttle is unable to reduce the position of the metering valve below that demanded by the speed selector. The speed selector must therefore be placed in FLIGHT IDLE to permit control over the entire engine operating range with the emergency throttle.

CAUTION

The stopcock function is controlled by the pilot's speed selector even though the engine is being governed manually with emergency throttle.

Fuel Density Adjustments

Two adjustments are provided in the engine fuel system to compensate for the various densities of different types of fuel. An adjustment located on the fuel control, marked SPECIFIC GRAVITY, is calibrated in pounds and tenths. The specific gravity of JP-4 and JP-5 are identified for ready reference. The setting of this adjustment should correspond to the specific gravity of the fuel in the fuel lines and fuel control. The second adjustment is a spring loaded, depress-to-turn, knurled knob located on the flow-divider. It has two positions; full clockwise for JP-4 and full counterclockwise for JP-5. These adjustments affect engine starting characteristics and should correspond to the type of fuel in the fuel lines and fuel control. This should be kept in mind when servicing the aircraft with different types of fuels. JP-4 should be used at all fuel temperatures below -29°C (-20°F) and JP-5 should be used at temperatures above +38°C (+100°F).

APPROVED FUELS

Fuels conforming to MIL-T-5624 for JP-4 and JP-5 are approved for use in the T58-GE-8B engine. The following is a list of approved fuels:

WARNING

The use of Fuel System Icing Inhibitor in jet fuel is mandatory. Fuels obtained from military facilities contain ice inhibitor. Aviation units and flight crews shall ensure its presence in any commercial fuel procured. Icing inhibitor shall be used in a ratio of 0.08% - 0.20% by volume (approximately 1 pint per 100 gallons of jet fuel). Additive should meet requirements of MIL-I-27686E (commercial name PRIST).

SPECIFICALLY APPROVED COMMERCIAL FUELS

Company	Product Name	Density Setting
American Oil Co.	American Jet Fuel Type A	JP-5
	American Jet Fuel Type A-1	JP-5
Atlantic- Richfield	Arcojet A	JP-5
	Acrojet A-1	JP-5
	Acrojet B	JP-4
British Petroleum Co., Ltd.	BP A.T.K.	JP-5
	BP A.T.G.	JP-4
	BP AVCAT 48	JP-5
California-Texas	Caltex Jet A-1	JP-5
	Caltex Jet B	JP-4
Cities Service Oil Co.	Turbine Type A	JP-5
Continental Oil Company	Conoco Jet-40	JP-5
	Conoco Jet-50	JP-5
	Conoco Jet-60	JP-5
	Conoco JP-4	JP-4
Empire State	SMC	JP-5
Exxon International	Exxon Turbo Fuel A-1	JP-5
	Exxon Turbo Fuel A	JP-5
	Exxon Turbo Fuel B	JP-4
Gulf Oil Corp.	Gulf Jet A	JP-5
	Gulf Jet A-1	JP-5
Humble Oil & Refining Co.	Exxon Turbo Fuel A-1	JP-5
	Enco Turbo Fuel A-1	JP-5
	Exxon Turbo Fuel A	JP-5
	Enco Turbo Fuel A	JP-5
	Exxon Turbo Fuel B	JP-4
	Enco Turbo Fuel B	JP-4
	Exxon Turbo Fuel 5	JP-5
	Enco Turbo Fuel 5	JP-5
Mobil Oil Co.	Mobil Jet A	JP-5
	Mobil Jet A-1	JP-5
	Mobil Jet B	JP-4
	Mobil Jet 4	JP-4
	Mobil Jet 5	JP-5
Phillips Petroleum Co.	Philjet A-50	JP-5
	Philjet JP-4	JP-4
Pure Oil Co.	Purejet Turbine Fuel Type A	JP-5
	Purejet Turbine Fuel Type A-1	JP-5
Shell Oil Co.	Aeroshell Turbine Fuel JP-4	JP-4
	Aeroshell Turbine Fuel 640	JP-5
	Aeroshell Turbine Fuel 650	JP-5
Sinclair Refining Co.	Sinclair Superjet Fuel	JP-5
Chevron Oil Co.	Chevron Jet Fuel A-1	JP-5
	Chevron Jet Fuel B	JP-4
Standard Oil Co. (Kentucky)	Standard JF A	JP-5
	Standard JF A-1	JP-5
Standard Oil Co. (Ohio)	Jet A Kerosene	JP-5
	Jet A-1 Kerosene	JP-5
Standard Oil Co. (Texas)	Standard Turbine Fuel A- 1	JP-5
	Standard Turbine Fuel B	JP-4

Company	Product Name	Density Setting
Texaco, Incorp.	Texaco Avjet A	JP-5
	Texaco Avjet A-1	JP-5
	Texaco Avjet B	JP-4
Union Oil of California	76 Turbine Fuel	JP-4
	Union JP-4	

INDUSTRY/GOVERNMENT SPECIFICATIONS

Air Total Turbine Fuel, 1 and 1A	JP-5
ASTM Jet A Aircraft Turbine Fuel	JP-5
ASTM Jet B Aircraft Turbine Fuel	JP-4
ASTM Jet A-1	JP-5
British Fuel D ENG. R.D. 2482, AVTUR 40	JP-5
British Fuel D ENG. R.D. 2486 AVTAG	JP-4
British Fuel D ENG. R.D. 2494, AVTUR 50	JP-5
British Fuel D ENG. R.D. 2498, AVCAT 48	JP-5
British Fuel D ENG. R.D. 2488, AVCAT	JP-5
Canadian Fuel 3-GP-22	JP-4
Canadian Fuel 3-GP-23	JP-5
MIL-T-5624G JP-4	JP-4
MIL-T-5624G JP-5	JP-5
NATO F-30 (Jet A)	JP-5
NATO F-34 (Jet A-1)	JP-5
NATO F-35 (Jet A-1)	JP-5
NATO F-40 (JP-4)	JP-4
NATO F-42 (JP-5)	JP-5
NATO F-44 (JP-5)	JP-5
NATO F-45 (JP-4)	JP-4

ENGINE OIL SYSTEM

The engine oil system (figure 1-6) is of the positive-displacement recirculating type system. The main points lubricated within the engine are as follows: The compressor rotor front bearing, and the engine accessory drive gear components, the compressor rotor rear bearing, the gas generator turbine bearing, the power turbine rotor bearing and the power turbine accessory drive gear components. The engine oil system components include an oil tank, a combined oil and scavenge pump, an oil filter, a relief valve, a check valve, and an oil cooler.

Engine Oil Tank

A circular oil tank installed around the engine front frame has a capacity of 3.0 gallons. An oil level dipstick gauge is located at the approximate 1 o'clock position on the tank and indicates 2.5 gallons as FULL. A filler cap is in the approximate 11 o'clock position.

Engine Oil Cooler

Operation of the oil cooler is entirely automatic. The oil cooler is an oil-to-fuel heat exchanger with an associated oil bypass valve. Oil flow through the cooler depends upon oil temperature. At lower temperatures, the pressure differential across the cooler causes most of the oil to bypass the core of the cooler. At higher temperatures, the lower viscosity reduces the pressure differential which closes the bypass valve and causes all of the oil to flow through the cooler.

STATOR VANE ACTUATING SYSTEM

The stator vane actuating system varies the angle of the inlet guide vanes and the first 3 stages of stator vanes to increase the efficiency of the compressor and to prevent compressor stalls. The actuating system is scheduled with respect to T_2 and N_g and is operated automatically by fuel pressure from the fuel control.

ROTOR OVERSPEED SYSTEM

The overspeed system (figure 1-7) provides a means of preventing a destructive overspeed of the main rotor and incorporates provisions for testing the circuit. The system consists of a rotor overspeed switch mounted on the accessory section of the main gear box, a solenoid-operated bleed valve mounted on the engine, and a microswitch mounted on the engine stator vane actuator. Also contained in the system is a circuit breaker, marked ENG OVSPD, on the forward circuit breaker panel, a test switch, marked ENG OVSP TEST, on the overhead switch panel, (figure FO-2) and the necessary wiring to operate the components of the circuit.

Rotor Overspeed Switch

The rotor overspeed switch is mounted on the accessory section of the main transmission. It incorporates one set of electrical contacts which close at 110%N_r.

Stator Vane Actuator Switch

The stator vane actuator switch (figure 1-7) is mounted on the stator vane actuator and is wired in series with the P_3 solenoid valve. Its function is to prevent the engine from decelerating to dangerously low speeds during overspeed conditions. The stator vane actuator switch opens when Ng drops to 72%±3%, interrupting electrical power to the P_3 solenoid valve. This action limits N_g deceleration to 72% ± 3% during rotor overspeed conditions.

P3 Solenoid Valve

The P_3 solenoid valve (figure 1-7), mounted on the engine, is installed in the tubing that carries the com-

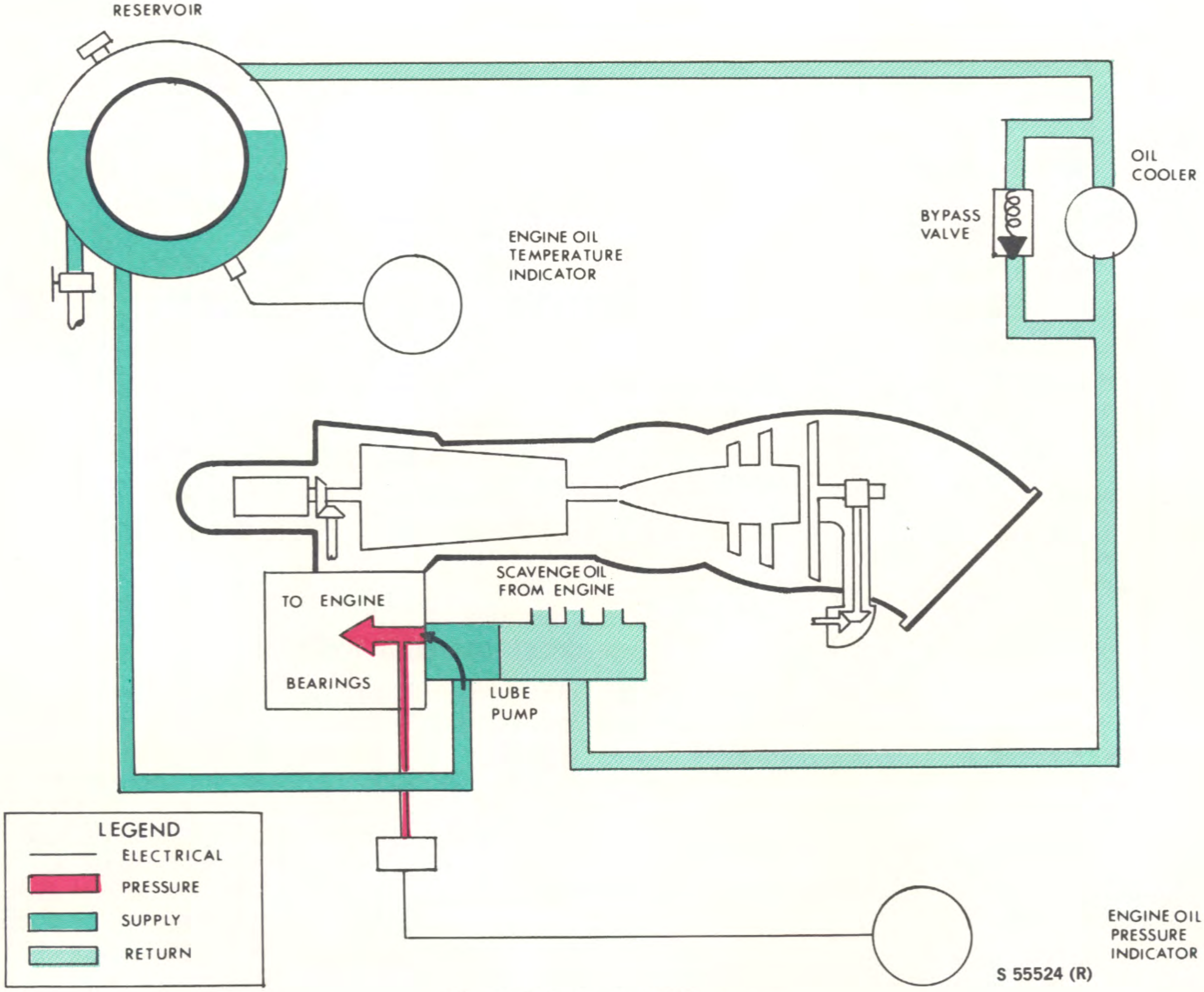


Figure 1-6. Engine Oil System

pressor discharge pressure signal to the fuel control. When electrically energized, the solenoid valve opens, bleeding the P3 signal to the atmosphere. The false signal thus transmitted to the fuel control causes an immediate reduction in fuel flow.

Overspeed Test Switch

The overspeed test switch permits an operational check of system components at speeds below 110% Nr. The two-position switch lever-lock is on the overhead switch panel (figure FO-2) under the heading ENG OVSPD TEST marked NORMAL and NO. 1. Stator vane actuator switch operation is checked in the NO. 1 position. Operation of the P3 solenoid valve is checked during the NO. 1 test.

IGNITION SYSTEM

The ignition system consists of a capacitor discharge unit, two ignitors, and a control circuit (figure 1-8). During engine start, the ignition unit furnishes a spark to ignitor plugs which ignites the fuel-air-mixture in the combustion chamber of the engine. The ignition unit operates on 28 volts DC from the start bus and fires the two ignitor plugs. The system is protected by a circuit breaker, marked START & IGN, under the general heading START BUS, which is on the forward circuit breaker panel.

Ignition Switch

The ignition switch, marked IGN, with positions TEST, OFF, and NORM, is on the overhead switch panel (figure FO-2). The lever lock prevents inadvertent movement to the NORM position and the TEST position is momentary. In the NORM position with the starter switch depressed, current from the start bus will flow to the ignition unit when the speed selector is turned to GROUND IDLE. Current flow to the ignition stops when the starter switch is released. The

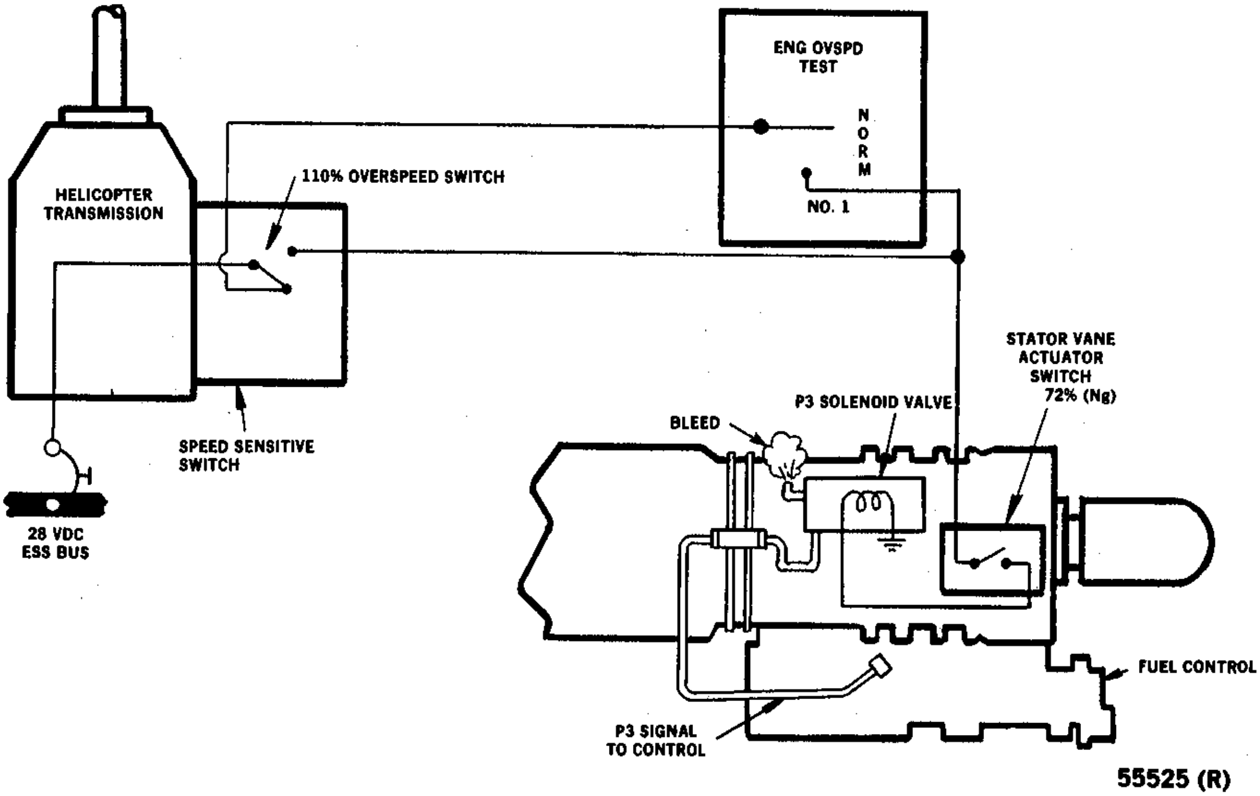


Figure 1-7. Main Rotor Overspeed Switch System

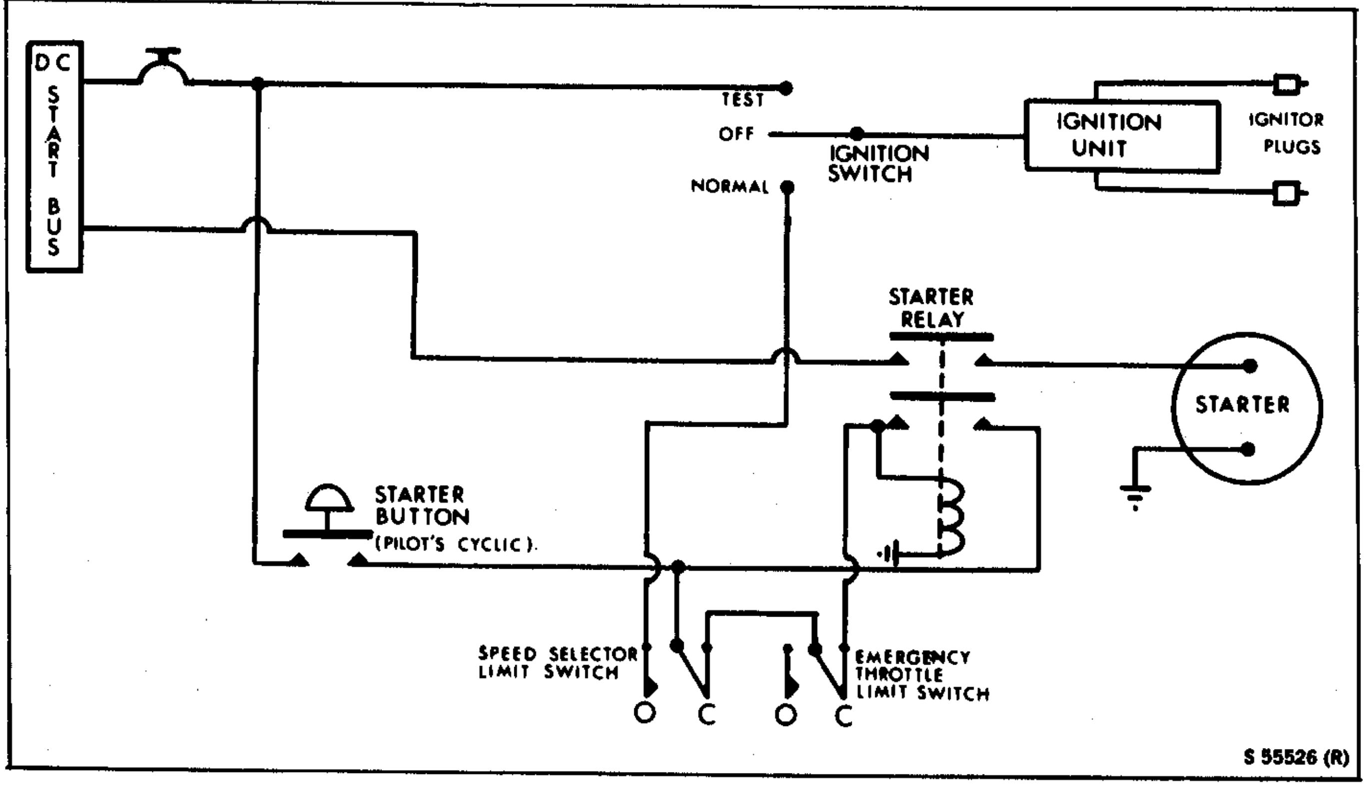
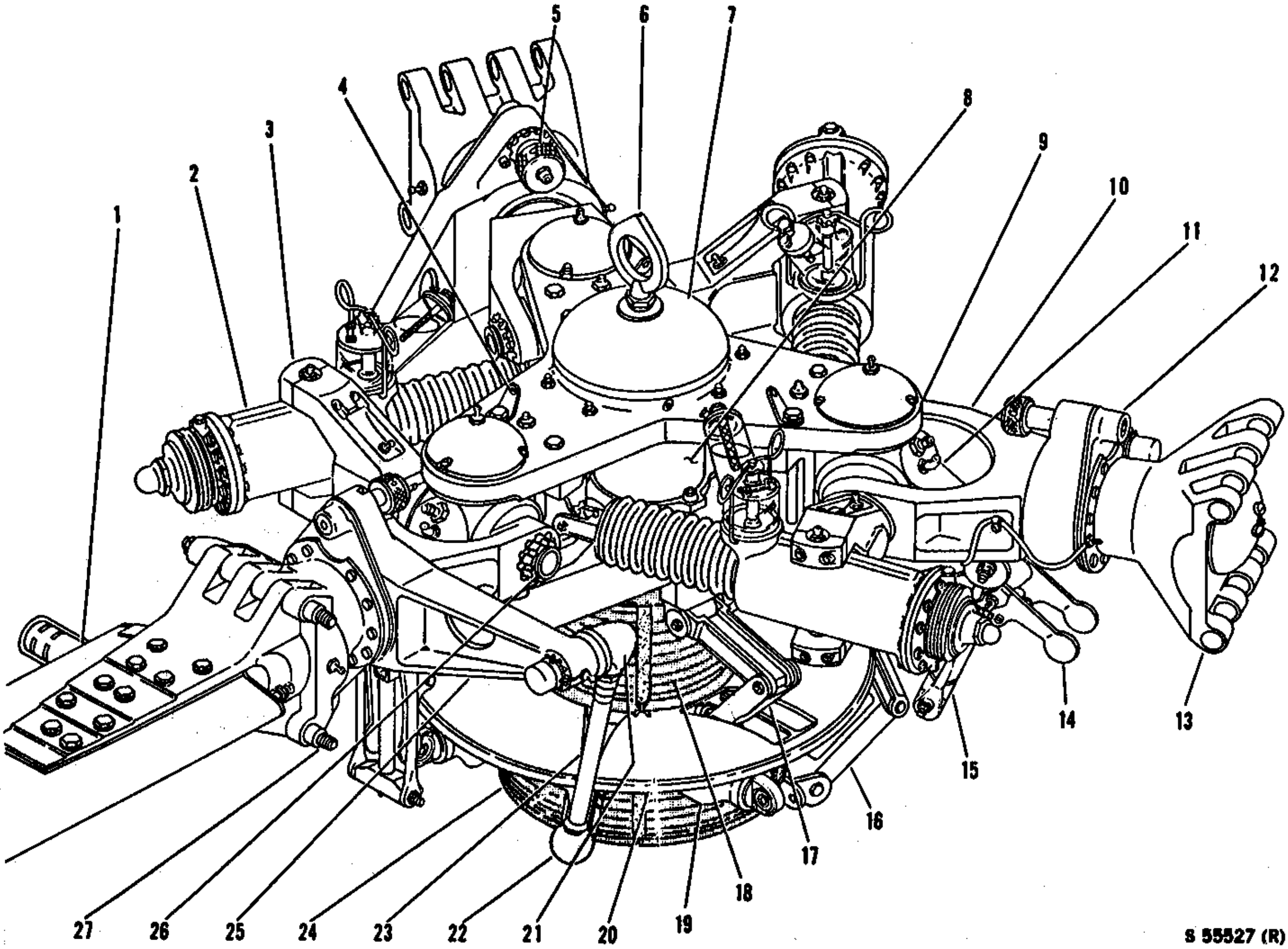


Figure 1-8. Starter and Ignition Systems



1. Main Rotor Blade
2. Damper
3. Damper Arm
4. Hoisting Lug
5. Blade Lock
6. Hoisting Eye
7. Cover
8. Hub
9. Upper Plate
10. Sleeve-Spindle Assembly
11. Vertical Hinge Assembly
12. Blade Lock Bracket
13. Sleeve
14. Droop Restrainer (Flight Position)
15. Anti-Flapping Restrainer
16. Stationary Scissors
17. Rotating Scissors
18. Boot
19. Stationary Star
20. Rotating Star
21. Boot
22. Boot
23. Pitch Control Rod (Adjustable)
24. Boot
25. Horn
26. Horizontal Hinge Pin
27. Taper Pin

Figure 1-9. Main Rotor Head

TEST position is used to operate the ignition unit at times other than during engine starting. When the ignition switch is placed in the momentary TEST position, current from the start bus flows directly to the ignition unit.

STARTER SYSTEM

The starter system (figure 1-8) consists of a starter motor mounted on the front frame of the engine, a starter relay, and a starter switch. The starter motor is protected by a bullet-nose cover. Two pulley limit switches must be closed by placing the engine speed selector in STOPCOCK and emergency throttle in the CLOSED position before the starter motor can be energized. When the starter button is depressed current from the start bus energizes the starter relay, allowing current from the start bus to activate the starter motor. Once the starter relay is energized it remains energized until the starter button is released.

Starter Switch

The starter switch is a push-button type momentary switch on the pilot's cyclic stick below the grip (figure 1-19). When the starter switch is depressed, the starter motor is energized. Releasing the starter switch breaks the circuit to the starter motor. Power is supplied from the START bus through a circuit breaker marked START & IGN, under the general heading START BUS on the forward circuit breaker panel.

ENGINE INSTRUMENTS

Dual Tachometer (Power Turbine and Rotor)

Two electrically-operated dual tachometers which indicate power turbine speed (N_f) and rotor speed (N_r) are on the instrument panel in front of the pilot and copilot (figure FO-1). The power turbine tachometer-generator is on the fuel control and is driven by the power turbine flex shaft. The rotor tachometer-generator is mounted tandem on the rotor speed switch and driven by the main gear box. Both tachometer-generators are synchronized to line up the tachometer needles when the engine is driving the main gear box.

Gas Generator Tachometer

The gas generator tachometer, on the instrument panel (figure FO-1), operates on current developed by a tachometer-generator which senses gas generator speed (N_g). The tachometer will indicate up to 110% gas generator speed.

Power Turbine Inlet Temperature Indicator

A power turbine inlet temperature (T_5) indicator, on the instrument panel (figure FO-1), is wired to eight thermocouples projecting into the hot-gas stream immediately ahead of the power turbine. The thermocouples, connected with a balance-resistance harness, are wired to a thermocouple spool resistor that varies the current flowing to the gage.

Engine Oil Pressure Indicator

An engine oil pressure indicator, on the instrument panel (figure FO-I), is wired to an oil pressure transmitter installed on the discharge side of engine oil pump. The indicator operates on 26 volts from the ϕC autotransformer and is protected by circuit breaker, marked ENG OIL PRESS, on the forward circuit breaker panel.

Engine Oil Temperature Indicator

An engine oil temperature indicator, on the instrument panel (figure FO-1), is wired to a temperature bulb installed on bottom of the oil tank. The indicator operates on 28 volts from the DC essential bus and is protected by a circuit breaker, marked OIL TEMP, under the general heading ENGINE, on the forward circuit breaker panel.

Fuel Pressure Indicator

The fuel pressure indicator installed on the instrument panel (figure FO-1), indicates fuel pressure in pounds per square inch as measured at the fuel inlet on manifold. The system operates on 26 volts from the ϕC autotransformer and is protected by a circuit breaker, marked FUEL PRESS, on the forward circuit breaker panel.

ROTOR SYSTEMS

The rotor system consists of a main rotor and an anti-torque tail rotor. Both systems are driven by the engine through the transmission system and are controlled by the flight controls.

MAIN ROTOR SYSTEM

The main motor system consists of the main rotor head assembly and the rotor blades. The head assembly, mounted directly above the main gear box, consists of a hub assembly and a swash plate assembly. The hub assembly (figure 1-9), consisting of three sleeve-spindle assemblies and three hydraulic dampers clamped between two parallel plates, is splined to the main motor shaft. The root ends of the three rotor blades are attached to the sleeve-spindle assemblies which permit each blade to flap vertically, hunt horizontally, and rotate about their span-wise axis. In a static condition, anti-flap restrainers limit the up movement of the blades and droop restrainers limit the downward movement. In flight, both the anti-flap restrainers and droop restrainer are extended by centrifugal force to allow free movement of the blades. When the rotor is slowed for shutdown, spring tension draws the droop restrainers in place at approximately 60-56% rotor speed and the anti-flap restrainers in at approximately 20%. The hydraulic dampers mimimize hunting movement of the blades about the vertical hinges as they rotate, prevent shock to the blades when the rotor is started or stopped, and aid in the prevention of ground resonance. The blades can be folded back from the attachment points at the sleeves of the main rotor hub. The three all-metal main rotor blades are of the pressurized spar type, identified as BIM® blades (figure 1-10). The blades are constructed of aluminum with the exception of forged steel cuffs which attach the root ends of the blades to the sleeve-spindle assemblies on the main rotor hub. Each blade consists of a hollow extruded aluminum spar pressur-

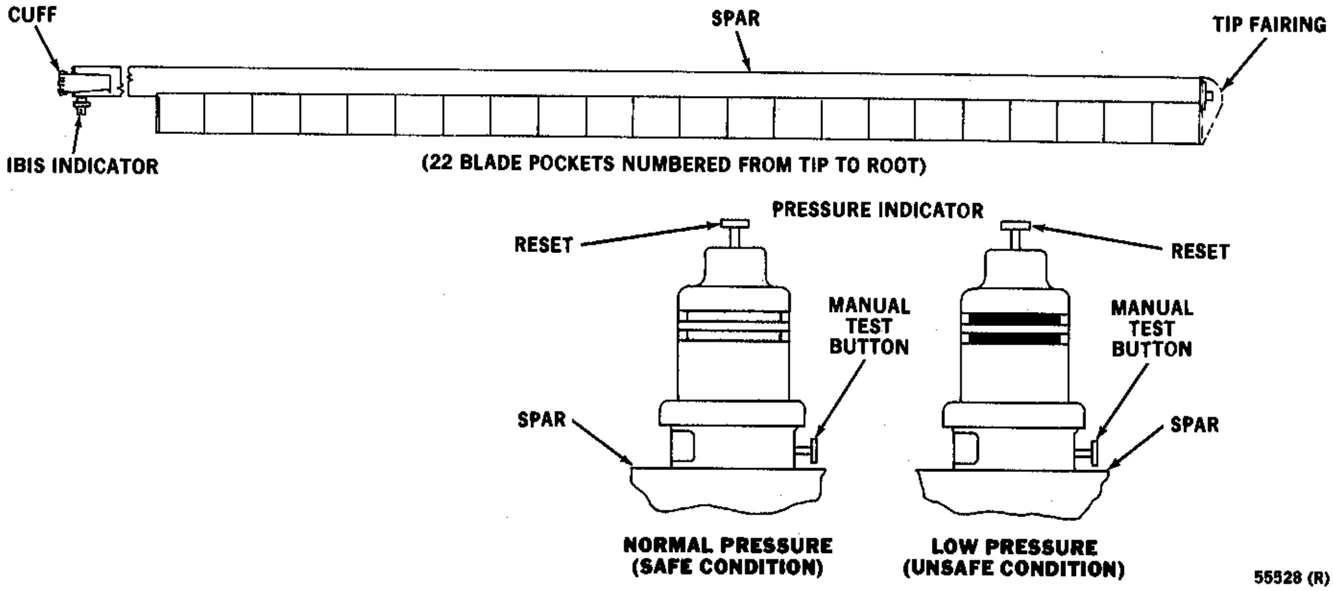


Figure 1-10. Main Rotor Blade

ized with nitrogen, 22 sheet aluminum blade pockets, a tip cap, a root cap, a steel cuff a pressure (BIM) indicator, and an air valve. The blade pockets are constructed of an aluminum foil honeycomb with an alumium skin covering. Each blade is balanced statically and dynamically within tolerances that permit individual replacement of the blades. A pretrack number is stenciled on each blade to eliminate the necessity for blade tracking. Balancing and the assignment of a pretrack number is done during manufacture or overhaul. The swashplate assembly consists of an upper (rotating) swashplate, which is driven by the rotor hub, and a lower (stationary) swashplate, which is secured by a scissors assembly to the main gear box to prevent rotation. Both swashplates are mounted on a ball-ring and socket assembly, which allows them to be tilted, raised, or lowered simultaneously by components of the main rotor flight control system, which connect to arms on the lower (stationary) swashplate. Cyclic or collective pitch changes, introduced at the stationary swashplate, are transmitted to the blades by linkage (pitch change rods) on the rotating swashplate.

BIM (Blade Inspection Method) Indicators

A cylindrical BIM indicator is in the back wall of the spar at the root of each main blade and an air valve is in the root end plate of the blade. The pressure indicator has a transparent cover through which a color indication can be observed to determine blade serviceability. The indicator, compensated for temperature changes, compares a reference pressure, built into the indicator, with the pressure in the blade spar. When the pressure in the spar is within the required service limits, three yellow stripes show in the indicator, indicating the blade is serviceable. If an unforeseen combination of events should occur impairing the structural integrity of the spar, or if a seal should leak, nitrogen pressure will decrease. If the pressure in the blade spar drops below the minimum permissible service pressure, the indicator will be actuated and will show three red stripes.

WARNING

When red is visible in the indicator, the cause of the red indication shall be determined before accepting the helicopter for flight.

In-Flight Blade Inspection System (IBIS)

Helicopters modified by TCTO 1H-52-509 are equipped with an In-flight Blade Inspection System (IBIS) that visibly indicates in the cockpit as well as on an indicator that the pressure in one or more main rotor blade spars has dropped below allowable limits. The IBIS indicator (figure 1-10), which replaces the BIM indicator, contains a small radioactive source which is completely shielded and emits no radiation when the rotor blade spar is at normal pressure. When the pressure drops below prescribed limits, the indicator will activate causing the radioactive source to move to an unshielded position, thereby emitting beta radiation. The detector assembly, on the transmission oil cooler fairing assembly, detects the beta radiation and sends a signal to the signal processor. The signal processor causes the BLADE PRESS caution light to go on. Loss of pressure in the blade spar is also indicated by the IBIS indicator on the blade. The indicator, compensated for temperature changes, compares a reference pressure built into the indicator with the pressure in the blade spar. When the pressure in the blade spar is within the required service limits, two yellow stripes show in the indicator. If the pressure in the blade spar drops below the minimum permissible service pressure, the indicator will activate and show two red stripes. Loss of AC power, failure of the detector, and/or failure of the signal processor will cause the BLADE PRESS caution light to go on. The system receives power from the AC essential bus and is protected by a circuit breaker marked IBIS AC ESS on the aft circuit breaker panel. The caution light is powered by the DC essential bus and is protected by a circuit breaker marked IBIS DC ESS on the aft circuit breaker panel.

WARNING

When red is visible in the indicator,the cause of the red indication shall be determined before accepting the helicopter for flight.

NOTE

A protective cover, on the Standard SAR Board, is for use in case of a red indication on the IBIS Indicator. The cover is designed to eliminate radiation leakage.

TAIL ROTOR

The tail rotor system consists of two variable pitch, all metal blades, counterweight assembly, and tail rotor hub. The tail rotor hub is splined to the tail rotor gear box output shaft which transmits engine torque to the tail rotor hub and blades. The blade pitch change mechanism is contained inside the tail rotor gear box output shaft and is connected to the tail rotor flight control system. Control rods from the counterweight beam assemblies to the sleeves on the blades can be adjusted to fixed values. Centrifugal force acting on the counterweights set the pitch of the blades if the tail rotor controls fail. The tail rotor counterweights are rigged to provide an approximate stable heading in a hover should loss of tail rotor control occur.

ROTOR BRAKE SYSTEM

The rotor brake system (2, figure 1-12) is a manually operated hydraulic system for stopping the rotor at shutdown or holding the rotors and power turbine during starting or with gas generator at ground idle. The rotor brake system consists primarily of a hydraulic panel incorporating a relief valve, accumulator, pressure switch; a caution light, a master cylinder, rotor brake, and connecting hydraulic lines.

HYDRAULIC PANEL

The pressure switch, accumulator, and relief valve are connected in the hydraulic line between the master cylinder and the rotor brake. These three components comprise the hydraulic panel. The pressure switch, when actuated, powers the warning light on the instrument panel. The accumulator is installed in the hydraulic system to compensate for expansion or contraction of the hydraulic fluid due to temperature changes. If the line pressure reaches 650 psi, the relief valve opens to bypass the excessive pressure to the auxiliary reservoir. The master cylinder reservoir is filled when the handle is in the off (detent) position.

ROTOR BRAKE CAUTION LIGHT

The rotor brake caution light, marked ROTOR BRAKE, is on the caution-advisory panel, (figure 1-27) on the instrument panel. It goes on when the pressure in the brake line exceeds 10 ±1 pounds PSI. 28 volts DC power for the system is taken from the essential bus through a circuit breaker, marked ROTOR BRAKE, on the forward circuit breaker panel.

MASTER CYLINDER

Hydraulic fluid from the auxiliary reservoir furnishes fluid to the master cylinder mounted on the center frame of the windshield. The master cylinder is hand-operated and furnishes hydraulic pressure to actuate the rotor brake, on the main gear box. The rotor brake is applied by pulling down and pushing forward on the handle (36, figure 1-2). A spring-loaded lock, at the right side of the cylinder, automatically locks the brake lever in the applied (down) position if the pilot places the small handle in the vertical or downward position. The lockpin must be pulled out in order to allow rotor brake release. The lockpin may be made inoperative by turning it until it remains in the OUT position.

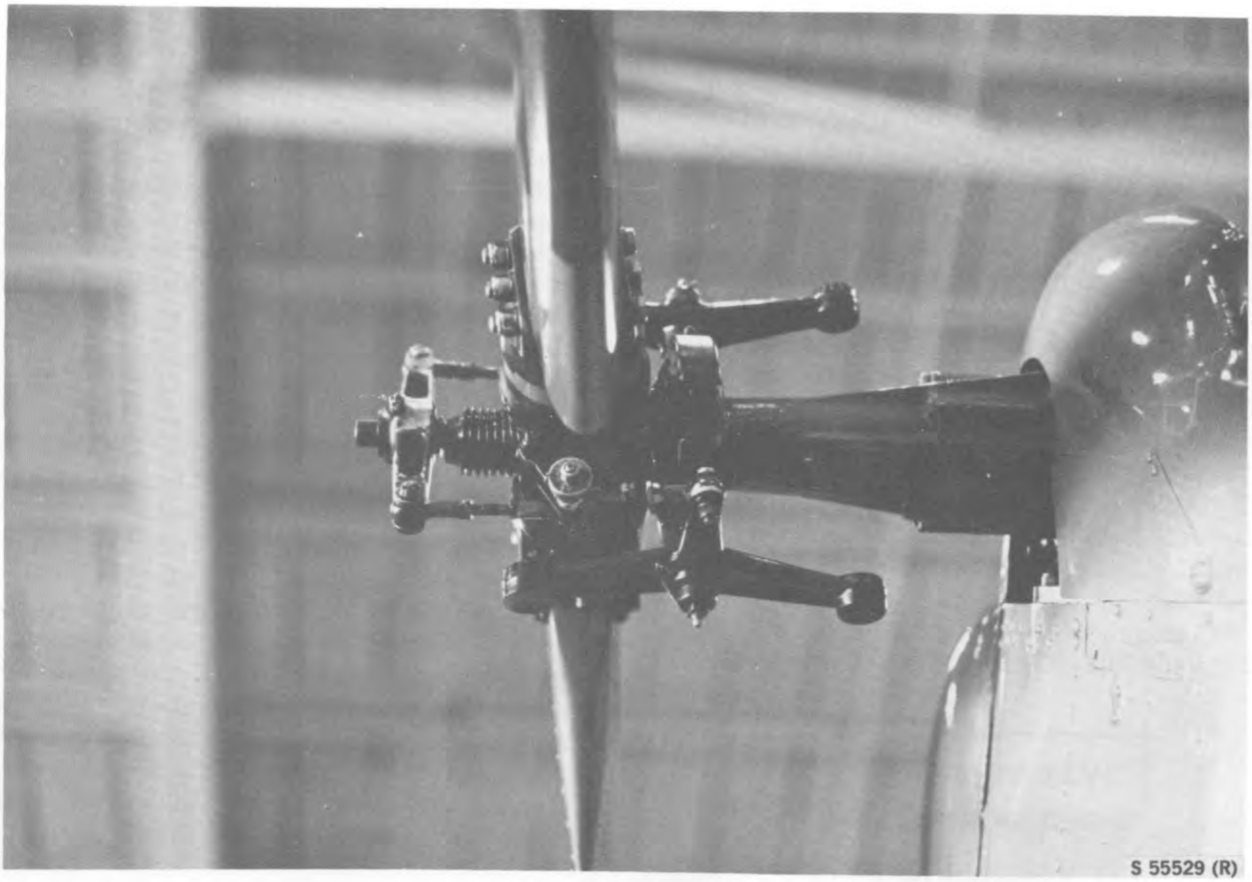


Figure 1-11. Tail Rotor Hub

ROTOR BRAKE

The rotor brake consists of a cylinder assembly positioned at the side of the brake disc. This cylinder assembly consists of two cylinder housings, two pistons, and two brake pucks. The brake disc is mounted on the rotor brake takeoff flange on the input housing of the main gear box. The rotor brake cylinder assembly is mounted on a bracket attached to the lower input housing of the main gear box. Hydraulic pressure forces the pucks against opposite sides of the brake disc causing drag to stop the rotor. The rotor brake cylinder is self-adjusting for wear of the brake pucks.

TRANSMISSION SYSTEM

The transmission system (figure 1-12) consists of three gear boxes (main, intermediate, and tail) and interconnecting shafting for the transmission of engine power to the rotor systems. The main gear box reduces engine speed, supports and drives the main rotor and furnishes a means of driving the tail rotor. An intermediate gear box changes the direction of the drive and shafting from the main gear box to the tail gear box. The tail gear box, in turn, drives the tail rotor.

MAIN GEAR BOX

The main gear box, mounted above the cabin aft of the engine, reduces engine speed to the main rotor through a five-stage reduction gear system at a ratio of 85.839 to 1. The main gear box also reduces engine speed at a ratio of 12.274 to 1 for driving the tail rotor. A freewheeling unit in the input housing to the gear box permits main rotor speed to exceed engine speed without engine drag. When the engine is driving the main rotor shaft, the rollers in the freewheeling unit are forced by cam action to lock the freewheeling cam and the output gear. Power is then transmitted from the freewheeling output gear into the main gear box. When the engine is not driving the main rotor shaft, the rollers in the freewheeling unit remain in the roller retainer, disengaged from the freewheeling cam. This allows the main rotor shaft to rotate independently from the main drive shaft. An accessory section (figure 1-13), at the rear of the main gear box, drives the

1. Main Drive Shaft
2. Rotor Brake
3. Freewheeling Unit
4. Auxiliary Hydraulic Reservoir
5. Auxiliary Hydraulic Pump
6. Transmission Oil Cooler
7. Tail Rotor Gear Box
8. Tail Drive Shaft Section (Section V)
9. Intermediate Gear Box
10. Splined Coupling
11. Tail Drive Shaft (Sections III and IV)
12. Oil Cooler Thermostat
13. Tail Drive Shaft (Section II)
14. Generator
15. Generator
16. Oil Pumps
17. Primary Servo Reservoir
18. Sight Plug

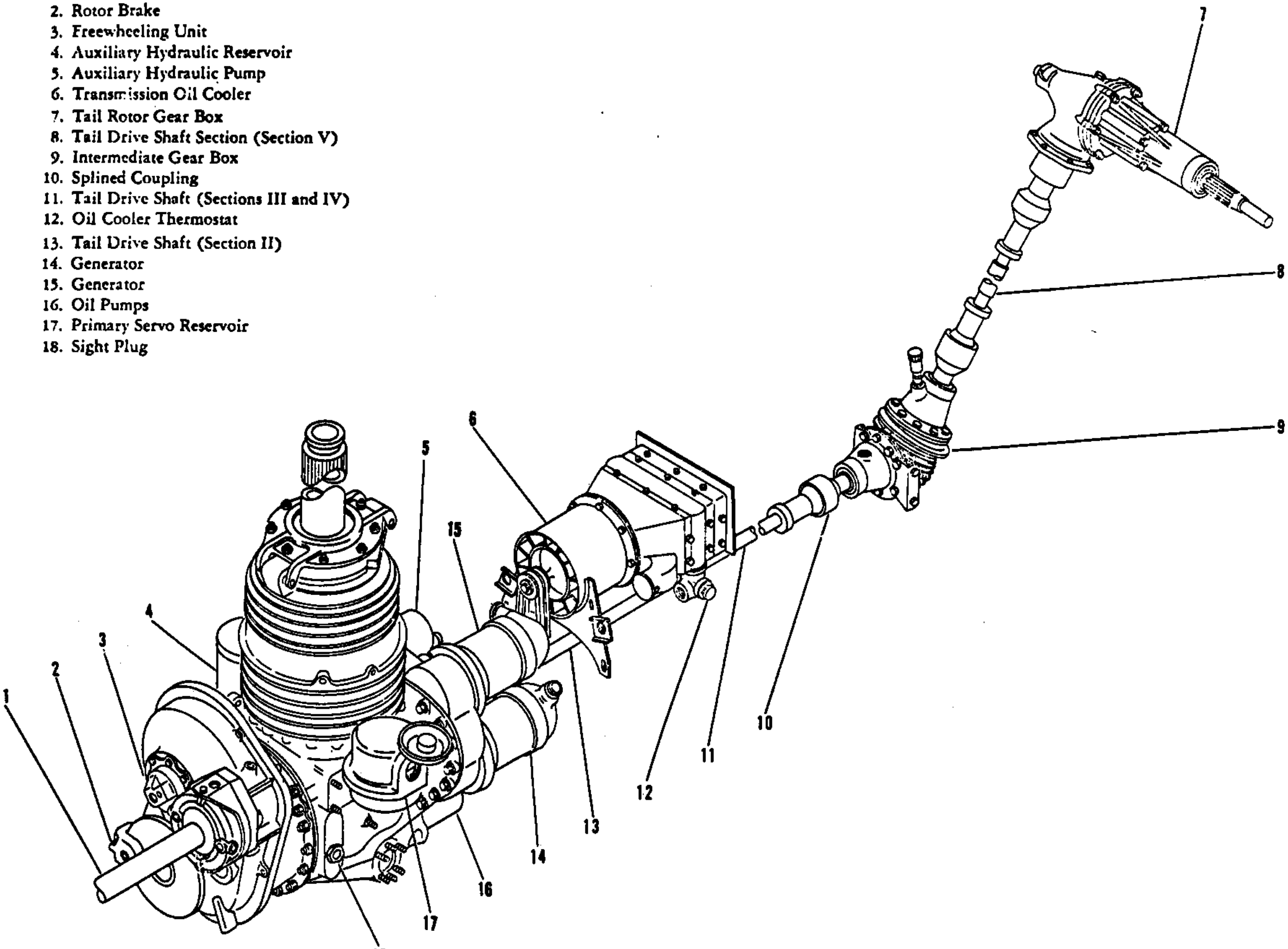
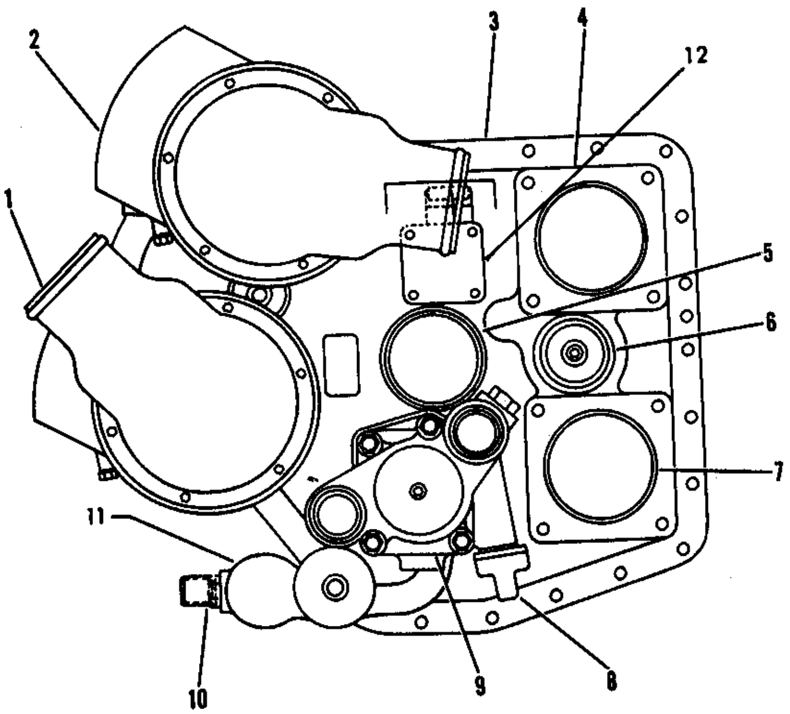


Figure 1-12. Transmission System

S 55530 (R)



1. No. 2 Generator
2. No. 1 Generator
3. Accessory Cover
4. Auxiliary Hydraulic Pump
5. Tail Rotor Take Off
6. Idler Gear
7. Primary Hydraulic Pump
8. Torquemeter Pressure Regulating Valve Adjustment
9. Oil Pump
10. Oil Return From Pressure Regulating Valve
11. Temperature Bulb
12. Speed Sensitive Switch

S 55531 (R)

Figure 1-13. Main Gear Box Accessory Section

two alternating current generators, the primary and auxiliary hydraulic pumps, the rotor speed switch with the tandem mounted rotor tachometer generator and the main gear box oil pump with the tandem-mounted torquemeter oil pump.

Chip Detector Caution Light

A main gear box chip detector caution light (figure 1-27), marked CHIP DETECTED, is on the caution-advisory panel. The light is connected to a magnetic chip detector in the main gear box. The caution light will visually indicate that the chip detector has picked up and retained metallic particles or chips present in the oil. The light operates on 28 volts DC from the essential bus and is protected by a circuit breaker, marked CHIP DET, on the forward circuit breaker panel.

INTERMEDIATE GEAR BOX

The intermediate gear box, at the junction of the tail cone and pylon, contains a bevel gear, direct drive system. Its only functions are to change the angle of the tail rotor drive shaft and transmit engine torque to the tail rotor gear box (figure 1-12).

TAIL ROTOR GEAR BOX

The tail rotor gear box at the upper end of the tail rotor pylon, contains a bevel gear reduction-drive system to transmit engine torque to the tail rotor. The tail gear box also contains part of the tail rotor pitch change linkage which extends through the hollow horizontal output shaft to the pitch change beam (figure 1-12).

TRANSMISSION OIL SYSTEMS

Main Gear Box Oil System

The main gear box lubrication system (figure 1-14) consists of drilled internal oil passages connected by external oil lines to a self-priming oil pump. The oil pump is on the lower accessory housing and receives oil from the oil sump at the bottom of the lower housing. Oil flows from the sump through an oil strainer/magnetic chip detector past a thermometer bulb to the pump. From the pump, the oil passes through a filter and pressure regulating relief valve to the oil cooler, aft of the main gear box. Cooling air enters the fairing through a screened intake and is forced through the oil cooler by a blower driven by belts and pulleys from the tail rotor drive shaft. The oil is then distrib-

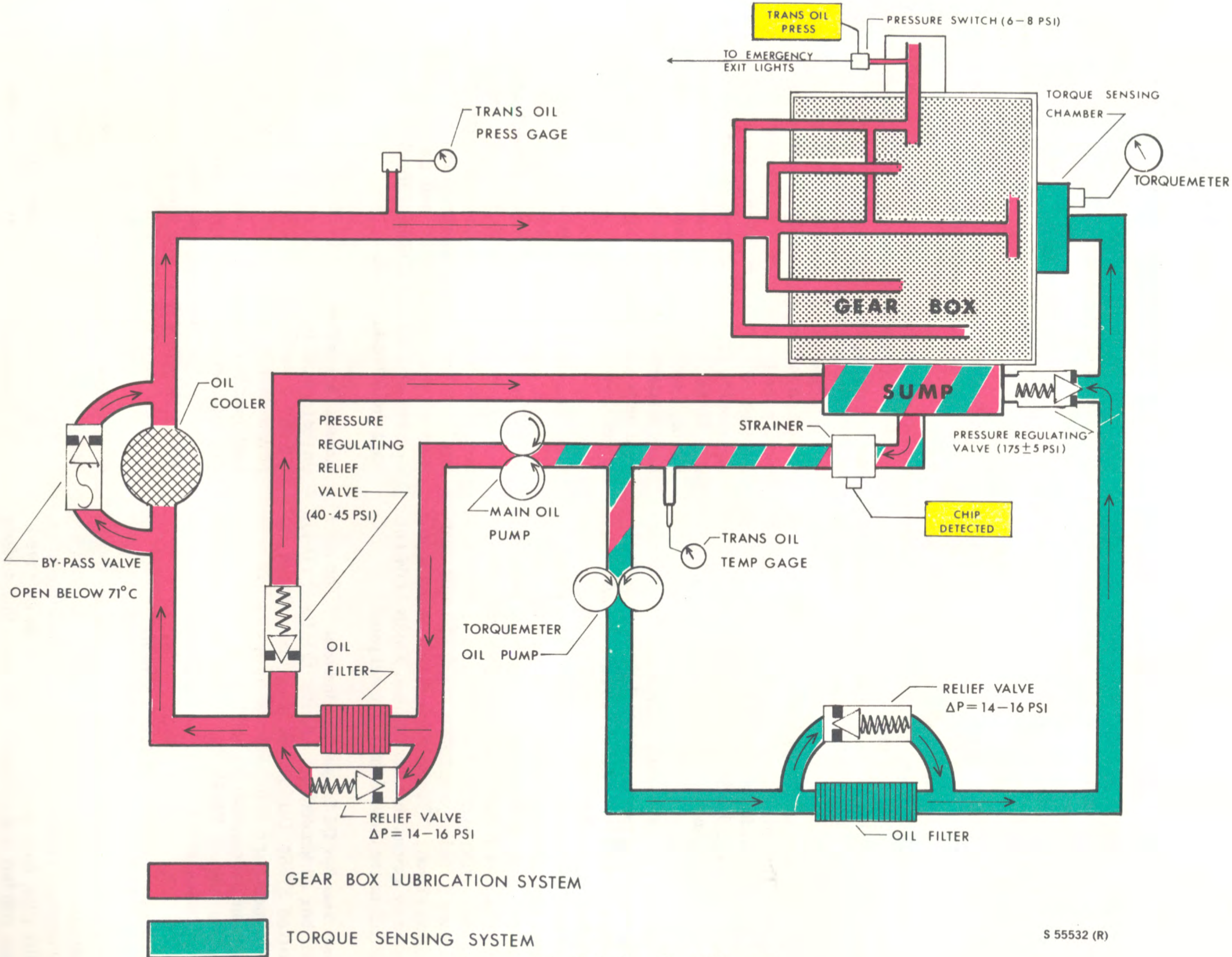


Figure 1-14. Main Gear Box Oil System

uted through internal oil passages and seven pressure jets to the bearings and gears and is returned to the sump by gravity flow. The torquemeter oil pump mounted tandem on the main gear box oil pump provides lubricating oil flow into the front cover of the gear box after passing through the torque sensing mechanism. The oil from the torquemeter pump returns to the same strainer as the main gear box oil pump. The torquemeter oil pump pressure is regulated by a pressure relief valve in the torquemeter oil pump housing. The main gear box oil level is indicated in a circular sight gage on the left side of the lower housing. An oil filler is on the left side of the main gear box.

Main Gear Box Oil Pressure Indicator The main gear box oil pressure indicator (27, figure FO-1), marked XMSN OIL PRESS, is in the center of the instrument panel. The function of the indicator is to display the main gear box inlet oil pressure in pounds per square inch. The indicator is electrically connected to a pressure transmitter which sends electrical signals to the indicator. The indicator operates on 26 volts AC from the ϕC autotransformer and is protected by a circuit breaker, marked XMSN OIL PRESS, on the forward circuit breaker panel.

Main Gear Box Oil Pressure Caution Light The main gear box oil pressure caution light (figure 1-27), marked TRANS OIL PRESS is on the caution/advisory panel and is completely independent of the oil pressure indicating system. The light is connected to a pressure switch which senses pressure at the point of lowest oil pressure in the main gear box lube system. When the oil pressure at the switch drops to approximately seven psi, the caution light goes on. The oil pressure indicator should read approximately 25 psi. The light operates on 28 volts DC from the essential bus and is protected by a circuit breaker, marked XMSN LOW OIL PRESS, on the forward circuit breaker panel.

Main Gear Box Oil Temperature Indicator The main gear box oil temperature indicator (23, figure FO-1), marked XMSN OIL TEMP, is in the center of the instrument panel. The indicator operates on 28 volts DC from the essential bus and is protected by a circuit breaker marked XMSN OIL TEMP on the forward circuit breaker panel.

Intermediate and Tail Gear Box Oil Systems

Both the intermediate and tail gear boxes are splash-lubricated from individual sump systems. Internal spiral channels insure oil lubrication to all gearing. An oil filler plug, drain plug, and oil level sight gage are in each gear box casing. When the oil in the intermediate gear box is at FULL on the oil level sight gage, it contains 1.25 pints. When the oil in the tail gear box is at FULL on the oil level gage it contains 0.72 pints.

Transmission Torque Indicating System

The torque indicating system provides a constant visual indication of engine torque input to the transmission. Components of the system include the torquemeter oil pump, torque sensing mechanism, torque sensor transmitter, two torquemeter indicators, two pressure switches, a time delay relay and an overtorque flag indicator. The torquemeter oil pump provides main gear box lubricating oil under pressure to the torque sensing mechanism (figure 1-14). This measures variations in torque system oil pressure caused by changes in the displacement of the main gear box second stage helical gear resulting from variations in engine input torque. The sensed pressure is received by the torque sensor transmitter and displayed in the cockpit on the torquemeters. If oil pressure within the sensing mechanism chamber increases above a value representing 100% torque, the elapsed time indicator is energized by the associated pressure switch. If oil pressure further increases to a value representing 116% torque, a second pressure switch trips the time delay relay energizing the overtorque flag indicator. The time delay relay allows momentary surges of overtorque above 116% before activating the flag indicator.

Torquemeter Indicator Two torquemeter indicators (2 and 33, figure FO-1), one for the pilot and one for the copilot, are on the instrument panel. Each indicator, marked PERCENT TORQUE, contains a single needle which indicates torque input to the main gear box in percent. The indicators operate on 26 volts AC from the ϕC autotransformer and are protected by a circuit breaker marked TORQUE SENSOR, on the forward circuit breaker panel.

Elapsed-Time Indicator An elapsed-time indicator is on the forward circuit breaker panel (figure FO-3). The indicator, marked HOURS AND HUNDREDTHS, provides a digital indication of the amount of time the main gear box has been operated above 100% torque. The indicator operates on 28 volts from the DC essential bus and is protected by a circuit breaker marked TORQUE SENSOR on the forward circuit breaker panel.

Flag Indicator A flag indicator is on the forward circuit breaker panel next to the elapsed time indicator (figure FO-3). The indicator can be identified by its circular, normally dull black face. When a 116% overtorque condition has existed for 4.5-5.5 seconds, a rec-

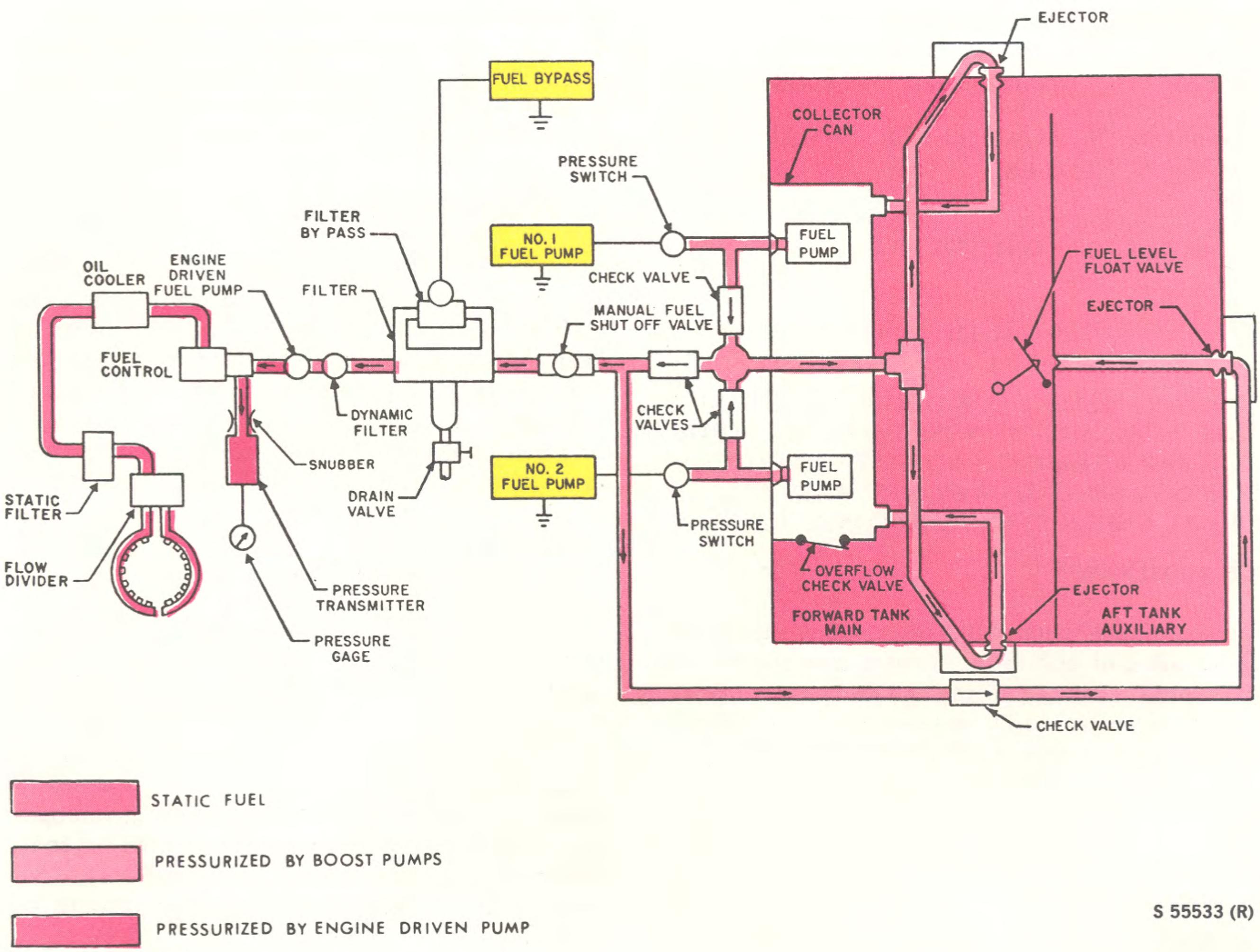


Figure 1-15. Fuel-Supply System

tangular fluorescent red flag appears. The indicator operates on 28 volts from the DC essential bus and is protected by a circuit breaker, marked TORQUE SENSOR, on the forward circuit breaker panel.

FUEL SUPPLY SYSTEM

The fuel system (figure 1-15) for the helicopter supplies fuel for the engine and heater. System components consist of two fuel cells, vent lines, two fuel boost pumps, airframe fuel filter, fuel filter bypass warning system, fuel transfer system, fuel pressure indicating system, a manual fuel shutoff valve and drain lines.

FUEL TANKS

The forward and aft non-sealing bladder type fuel tanks are installed below the cabin floor in the watertight lower fuselage section. Each tank has a filler unit on the left side of fuselage. The forward fuel tank has an additional filler unit, on the cabin floor, to enable the helicopter to be refueled while at rest on the water or from suitable containers during flight. A defueling valve is in the sump of each tank and is used to drain fuel from the tanks. Each tank sump also is equipped with a poppet-drain cock to be used to drain any water that may have accumulated in fuel tank sump. Both tanks are vented by lines that extend through the side of the fuselage. The forward fuel tank components consist of two ejectors and a three gallon collector unit containing the No. 1 and No. 2 fuel boost pumps. A float-type fuel level control is also installed in the forward tank to prevent overfilling in flight from the aft tank. The aft tank has one ejector unit.

FUEL QUANTITY DATA—U.S. GALLONS

Tank	Total Capacity	Unusable Fuel
Forward Tank and Collector Unit	187.0 GAL. (1216 LB.) (1272 LB.)	0.4 GAL. (2.6 LB.) (2.7 LB.)
Aft Fuel Tank	138.0 GAL. (897 LB.) 938 LB.	0.67 GAL. (4.4 LB.) (4.6 LB.)
TOTAL	325.0 GAL. (2113 LB.) (2210 LB.)	1.07 GAL. (7.0 LB.) (7.3 LB.)

THE PARAMETERS FOR DETERMINING UNUSABLE FUEL ARE: 5° NOSE-DOWN ATTITUDE. FUEL JP-4, 6.5 LB/GAL UNDER STANDARD CONDITIONS. SECOND WEIGHTS ARE JP-5, 6.8 LB/GAL UNDER STANDARD CONDITIONS.

FUEL BOOST PUMPS

Two electrically-operated fuel boost pumps submerged in the collector unit in the forward tank supply fuel under pressure to the engine and the ejectors. These pumps are controlled by two switches marked No. 1 and No. 2 with positions ON and OFF, under the general heading FUEL PUMP, on the overhead switch panel (figure FO-2). Normally both pumps are used for engine ground operation and flight. If either pump should fail, the remaining pump will continue to provide enough fuel pressure to operate the engine and fuel ejectors. The No. 1 fuel boost pump operates on direct current power from the start bus. The No. 1 fuel boost pump electrical circuit is protected by a circuit breaker, marked PWR, under the general heading No. 1 FUEL PUMP, on the forward circuit breaker panel. The No. 2 fuel boost pump operates on direct current from the DC non-essential bus and is protected by a circuit breaker, marked PWR, under the general heading No. 2 FUEL PUMP, on the forward circuit breaker panel.

Fuel Boost Pump Caution Lights

Each fuel boost pump has a low pressure warning light, on the caution-advisory panel (figure 1-27) marked NO. 1 FUEL PUMP and NO. 2 FUEL PUMP. Lighting of a warning light indicates the output pressure from the associated pump is insufficient for the engine-driven fuel pump and to maintain fuel flow to the collector unit thru the ejectors. The No. 1 fuel boost pump caution light operates on direct current from the start bus and is protected by a circuit breaker, marked WARN LT, under the general heading No. 1 FUEL PUMP, on the forward circuit breaker panel. The No. 2 fuel boost pump caution light operates from the DC essential bus and is protected by a circuit breaker, marked WARN LT, under the general heading No. 2 FUEL PUMP, on the forward circuit breaker panel.

AIRFRAME FUEL FILTER

An airframe fuel filter, on the left side of the transmission deck, decontaminates fuel. If contaminants clog the filter, a pressure differential develops between the inlet and the outlet ports. As the filter progessively clogs, the increasing pressure differential will actuate a pressure switch, lighting the fuel bypass warning light. Additional clogging will cause the internal bypass valve to actuate, allowing unfiltered fuel to flow to the engine.

Fuel Filter Bypass Caution Light

A fuel filter bypass caution light, marked FUEL BY-PASS on the caution advisory panel (figure 1-27), goes on when the airframe fuel filter pressure switch closes. Lighting of the FUEL BY-PASS caution light indicates that the airframe fuel filter is partially clogged and the bypass of unfiltered fuel to the engine is imminent or already in progress. The fuel filter bypass circuit operates on direct current from the DC essential bus and is protected by a circuit breaker, marked FILTER BY-PASS, under the general heading FUEL, on the forward circuit breaker panel.

FUEL SHUTOFF VALVE T-HANDLE

See Section I, FIRE EXTINGUISHER ARM T-HANDLE

A manually operated fuel shutoff valve on the port side transmission deck controls the flow of fuel through the main fuel line from the fuel boost pumps to the engine. The valve is used in the event the speed selector will not stop fuel flow to the engine. The valve is actuated by a T-shaped handle (figure 1-16) with marked positions, FUEL-ON (forward), FUEL-OFF (midposition), and FIRE EXT ARMED (aft), forward of the overhead switch panel (figure 1-2). When the T-handle is in the FUEL ON position, fuel is permitted to flow from the fuel booster pumps to the engine. When the T-handle is in the FUEL OFF position, the fuel shutoff valve is closed. After placing the T-handle in the FUEL-OFF position the engine will continue to operate on fuel in the line and fuel control for approximately 1 minute.